TECHNOLOGY DEPT.

COMMUNICATIONS

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ANNOUNCEMENT

The Communications of the Association for Computing Machinery, published by the Association for Computing Machinery, is a new monthly periodical which will be mailed to all members of the Association and subscribers of the Journal at no added cost. This new periodical is intended primarily for the rapid dissemination of information whose kind and quality will be of value to the membership of the Association.

To provide editorial supervision for the kind of material likely to be submitted the following departments have been constituted:

Computer Techniques
Unusual Applications
Standards
Official (ACM) Notices
Notices
Digital Computer News Letter of the Office of Naval Research
Letters to the Editor.

Statements of policy by the editors of these departments will be found in succeeding pages of this issue.

While the publishing of news and notices on a monthly basis is of undoubted value, it is hoped that the Communications will serve a more important purpose. Thus, this journal will provide space not elsewhere available for publishing worthwhile, but possibly fragmentary, developments in the use and understanding of computers, e.g., descriptions of computer programs, computer inspired techniques in numerical analysis, and educational efforts, to name a few. The Communications will also provide a forum for the Association's membership with the letters-to-the-Editor department. This department will be ideal for nourishing controversies that illuminate informed differences of opinion.

Material, other than notices, submitted to the Communications should be sent to the Editor-in-Chief. Notices should be submitted to the appropriate Notice department. Material submitted to the Journal or Communications will be considered for both periodicals and placed where the Editors consider most appropriate, unless the periodical of choice is specifically indicated. Material submitted for the Communications before the 20th of a given month will, whenever possible, be published in the issue for the following month.

ALAN J. PERLIS
Editor-in-Chief

LETTERS TO THE EDITOR

December 24, 1957

Dr. A. J. Perlis, Editor-in-Chief
Communications of the ACM
Carnegie Institute of Technology
Pittsburgh, Penna.

Dear Editor:

My best wishes go to you and the editorial staff of "Communications". It is a publication which has an important function to serve in the computer world.

Not the least important, in my estimation, is the "Letters to the Editor Department." This department can serve as a forum on all sorts of controversial questions—questions which will need answers, but which cannot be asked because either our purposes or our understanding are as yet too vaguely formulated.

As our language develops and we reach for appropriate expression of as yet unformulated concepts, we try to express such concepts in language already developed. Occasionally this economy of expression in already existing terms turns out to be impossible, and the impossibility is made manifest by the appearance of paradoxes. It is important that these paradoxes be publicly evident. To make them so, an open forum for loud and lusty argument is invaluable.

In my opinion, philosophy has served some of its most important functions to the world of communication in society by just such a critical evaluation of the fundamental concepts of the arts and sciences. In many cases some centuries of critical evaluation by philosophy have resulted in the emergence of major branches of science.

The general subject matter of the letters-to-the-editor department should include, then, the philosophy of computing, or, as I prefer to call it, "information transforming."

It is not hard to give examples of controversial matters in the computer area which can be settled only by taking a good look at our material and aims. In many cases such controversies appear to have already been settled; yet they will be reopened because the solutions accepted were only temporary ones determined by past limitations in understanding and available techniques. The technical limitations have, of course, been

1. reliability
2. speed
3. quantity of storage,

and, of course,

4. cost, both initial and running.

The general questions, which, I believe, are still open, all concern themselves with the kinds of general purpose machines we ought to have.

The first all-electronic machine, Eniac, in its original form, had certain inconveniences. To set up a program on it, one had to set up wired connections between the various arithmetic and storage registers. Later, the Eniac was so arranged that the same banks of switches (called function tables) which stored initial constants could also be made to set the required interconnections at the appropriate times. The design of the Edvac introduced the major step forward of having a common variable storage of instructions and data. This step, as did the previous one in the Eniac, replaced manipulation of hardware by the programming of coded symbols; even more, it established "command languages" for machines with the self-referencing properties possessed by the "descriptive languages" of our everyday speech. Moreover, it has been recognized that all general purpose machines, from Edvac on, are essentially equivalent, any one being capable of the same end results as any other, with varying degrees and types of efficiency. Thus two principles are recognized: that of the equivalence of hardware and programming; and that of

the equivalence of our general purpose machines with a certain, as yet ill-defined universal command language. (Probably, in terms of mathematical logic, it is the class of expressions obtainable by 'general recursive definitions').

The question of where we should be headed, in view of the technical trends of lower costs for greater speeds and larger quantities of storage, becomes that of deciding:

1. what command language structure is easiest and most flexible for our purposes,
2. how much of this structure should be left to hardware and how much to programming,
3. how fast we can, or should, make the machines,
4. how reliable we can, or should, make them.

On each of these points I would like to begin a general ACM conversation by tossing in a number of comments ranging from well-ruminated to half-baked. Then I will beat a hasty retreat to my dugout.

ad1. Convenient and flexible command language structures.

Edvac had a three-plus-one address word structure. The tendency has since been definitely toward one-address hardware and three-plus-zero address pseudo-codes. Programming and coding for Edvac was more logical and easier, redundancy in the use of that fourth address notwithstanding. Sentences with only one verb and one noun simply do not express big enough thoughts for most people. We want a language system in which each sentence has one or more verbs and an indefinite number of nouns. We want machine (or pseudo-machine) words to be complete sentences. In other words, we want variable instruction-word-length machines.

Furthermore, we want to be able to add new words to our language whenever they can be defined in terms of previous words. We want to be able to refer to complicated thoughts by single words. These thoughts can be orders or names, verbs or nouns. Thus we want the language to have such a structure that its indefinite expandibility is part of its everyday use. We want a variable control machine so that the order types, i.e., the verbs, may be varied. Note that this is a feature the original Eniac had, though the variation was by hand-wiring.

ad2. How much should be in the hardware and how much the job of programs?

My complaint in point 1 was that the present codes should be considered to be micro-codes. If the variable control and word-length features mentioned above are to be built in at the hardware level we have the point of view of the micro-programmers. An extreme attitude in this direction is to make the control a large mass of gates and delay lines every pair of which is connected by an addressable flip-flop; the totality of these flip-flops is similar to an enormous interconnection network of cross-bar switch; the micro-program sets those flip-flops we have addressed, and thereby establishes the order code we would like for the given applications. We then proceed by "ordinary" programming.

An even more extreme possibility is so to design the control that the particular groupings of hardware in the form of registers, counters, shifters, adders, accumulators, order type selectors, address selectors, etc., vary from moment to moment, and as the need for them arises. This would be not merely a variable control, but a machine which automatically schedules its components. Attempts in this direction might achieve considerable economy by increasing the duty cycle of many elements. One feels that there must be a hard core of elements with fixed structure and function below which one cannot go. How much is it? Further remarks in this direction belong to point 3.

Returning now to the achievement of flexible command languages by programming, rather than by hardware, we are talking about an expandable compiler. When storage was limited to a mere thousand or so words, internally, achieving even an approximation of such a compiler was quite a trick. With upward of thirty-thousand words of internal, fast-access storage we can afford to be more relaxed, though there is a reasonable limit; is it half the storage? Even so, such a compiler should have reasonable assistance from a fairly flexible machine structure. Since it is a user's world, the combination of machine

and compiler is the "machine" we are really interested in. The designers of automatic coding systems must therefore be considered among the machine designers, and should be involved before the hardware designers have finished their plans.

The pioneers in automatic coding were well aware of the identity of compilers and machines. Others need constant reminding.

ad3. What speed is needed or attainable?

To date the only truly parallel machines are analogue and not digital. Parallel access from the memory, or parallel operation of a number of input-output devices doesn't make a machine truly parallel, anymore than does telescoping three instructions so that, while one is being executed, the next is being decoded, and the third is being selected from the memory. The fact still remains that only one is in execution at a given moment. The bottle-neck is the existence of only one instruction register, one order-type-selector, etc. (A better word than "parallel," I have been told, is "concurrent-operating.")

We know that the so-called parallel computers are somewhat faster than the serial ones, and that no matter how fast we make access and arithmetic serially, we can do correspondingly better in parallel. However, access and arithmetic speeds seem to be approaching a definite limit, in the order of milli-microseconds. Does this mean that digital speeds are reaching a limit, that digital computation of multi-variate partial differential systems must accept it, and that predicting tomorrow's weather must require more than one day? Not if we have truly-parallel machines, with say, a thousand instruction registers.

But visualize what it would be like to program for such a machine! If a thousand subroutines were in progress simultaneously, one must program the recognition that they have all finished, if one is to use their results together. The programmer must not only synchronize his subroutines, but schedule all his machine units, unless he is willing to have most of them sitting idle most of the time. Not only would programming techniques be vastly different from the serial ones in the serial languages we now use, but they would be humanly impossible without machine intervention. A machine would be needed to solve the component synchronization and scheduling problems. If we try to solve this programming problem in parallel with the problem to be programmed we come up against the self-scheduling machine mentioned in point 2.

ad4. Can anything further be done for machine reliability or ease of maintenance?

As a general principle we know that the ultra-efficient information-transforming system, having no redundancy, cannot detect errors or correct its own errors. Thus, either for reliability of parts or for detection of errors computers are designed with redundancy of modules and redundancy in the information being processed. Now if we should want an uninterrupted computation, requiring a week, it is no solace that the one error every few days will be detected, unless it will also be corrected. Now codes of the Hamming type can be arranged to be correctible for reasonably infrequent occurrence of errors. Would it be possible, then, to design around Hamming codes an auto-diagnostic machine? Such a machine would have a monitoring print-out. Whenever an error occurred, it would, simultaneously, print out the identification of the occurrence and correct the error. The machine would not stop while a problem is running. When the problem is finished, the maintenance crew could adjust the machine in accordance with the printed record.

These, then, Al, are my heterogeneous thoughts, which I have found provocative. I send them to you in the hope that they may be similarly provocative to the ACM membership. Please remind them, however, that I am just as perplexed on many of the points, if not more so, than they. My wish is to be instructed by their answers.

Sincerely,
Dr. Saul Gorn
Director, Computer Center
University of Pennsylvania

SG/pb

TECHNIQUES DEPARTMENT

Policy Statement

This department solicits general contributions of new and usable information in the areas of programming, data processing, logical design and circuitry. Such material may refer to digital, analog, DDA or special purpose computers or combinations thereof. The following are general suggestions as to nature and form:

1. As in the Journal of the A.C.M., authors will be credited by name and affiliation, but not by title. Cooperative organizations are permitted to contribute equally.

2. It is preferable that techniques contributed be factual and in successful usage, rather than speculative or theoretical. One of the major criteria for acceptance and the question one should answer before submitting any material is—"Can the reader use this tomorrow?" It is requested that for the present all contributions be written in English.

3. Excerpts or modified excerpts from previously published material will be accepted if proper credit is given for original publication and permission is obtained when necessary. This provision is made for those cases where it is desirable to compact such information in a single journal which is both convenient and accessible to a group of readers with common interests.

4. Illustrations may include flow charts, line diagrams, tables, etc. They must be furnished on copy which is photo-reproducible. Photos and halftones will be discouraged but, if vital to the presentation, they will be accepted in glossy print form. Text may be submitted in any normally legible form.

5. Manuscripts will not be returned unless accompanied by a self-addressed stamped envelope. This department disclaims all responsibility for accuracy and correctness of material, although it will make reasonable efforts to monitor for inaccuracies. The contributor must make his own arrangements for protection of all material which concerns patentable items.

6. Digital computer sub-routines should be of general interest to a large class of users and normally independent of a particular computer, although examples with specific machines may be used for illustrative purposes. They should be presented in an acceptable report form (possibly determined by the standards department) and written to be easily adaptable to other computers. As it is likely that a large volume of these will be submitted, very high standards will be maintained for selection.

7. Some suggested categories for submitted material are:

- Automatic coding techniques
- Subroutines of general applicability
- Information on compilers and generators
- Information retrieval and language translation
- Business applications of digital computers
- Numerical and decision procedures
- Machine algebras
- Logic and programming
- Logical design
- Digital and analog circuits
- Reliability in design
- Simulation methods
- Combinational and sequential switching circuits

Contributions in any category which are thought more suitable for the Standards or Unusual Applications departments will be referred to the respective editors. If the volume is sufficient the department will be further sectioned and contributions will be categorized under these headings. For the present there are only two sections, (1) News and (2) Contributions. News is restricted to general statements of work in process or completed in the areas of compilers, utility routines, systems, logical design, etc.

I *NEWS*

The GUIDE organization of 705 users is sponsoring a cooperative project with IBM to produce a FORTRAN system for the 705 models I and II. The processor will be written with the conversion to 705 model III in mind so that the total effort will be minimized. Furnishing programming people for this project are:

Westinghouse Electric	Standard Oil Co. (Ohio)
Eastman Kodak	The Texas Co.
General Electric Co.	A. O. Smith Corp.

The first working version is expected to be tested by August 1958. The FORTRAN language which it accepts will be identical with that for the 709.

II *CONTRIBUTIONS*

To start, and by way of demonstrating how trivial contributions may be, I am showing one taken from the PRINT I system for the IBM 705, a serial, decimal, VET machine.

A MACHINE METHOD FOR SQUARE-ROOT COMPUTATION

R. W. BEMER
I.B.M. Corporation, New York City

Computers with operations having variable execution times (VET) require a different class of subroutines to take full advantage of these characteristics. Well-suited for computing square root on decimal machines is a variation of Newton's method which uses a linear first approximation such that convergence to the desired accuracy occurs in 2 iterations, thus causing a fixed and predetermined execution time.

Floating point square root routines operate on arguments of the form:

$N = M \cdot 10^P$ where $.1 \leq M < 1$, and M is always positive

To establish a common program for both odd and even powers (P) of 10, let

$N = m \cdot 10^p$ where $.01 \leq m < 1$, and p is always even.

Then, $\sqrt{N} = \sqrt{m} \cdot 10^{(.5p)}$ and $.5p = .5P$ (+ .5 when P is odd)

$$m = \left\{ \begin{array}{l} M \text{ (if P is even)} \\ .1M \text{ (if P is odd)} \end{array} \right\}$$

Iterating twice with initial approximation A_1,

$$\frac{m}{A_1} = Q_1 \qquad A_2 = .5\,(A_1 + Q_1) \qquad \frac{m}{A_2} = Q_2 \qquad \sqrt{m} \cong .5\,(A_2 + Q_2)$$

But $m = A_2Q_2 = A_2(A_2 + \Delta) = A_2^2 + A_2\Delta$

$$\frac{m - A_2^2}{2\,A_2} = \frac{A_2^2 + A_2\Delta - A_2^2}{2\,A_2} = \frac{\Delta}{2}$$

$$\sqrt{m} \cong \frac{A_2 + Q_2}{2} = \frac{2\,A_2 + \Delta}{2}$$

$$\sqrt{m} \cong A_2 + \frac{\Delta}{2} \cong A_2 + \frac{m - A_2^2}{2\,A_2}$$

This form is designed to minimize the number of digits of quotient which must be developed. Users of desk calculators will recognize it as the standard method of developing half of the required accuracy by long-hand square root method and dividing to place the second half of the root in juxtaposition. This method need not be followed, but the tables of segments of approximation still apply.

The starting approximation A_1 is derived by using a table of linear segments which approximate $\sqrt{m}$ within a prescribed tolerance. This tolerance T is a function of m and the allowable error ϵ in the final approximation. To compute T:

$$\frac{m}{A_1} = Q_1 = \frac{m}{\sqrt{m} + T_1} = \sqrt{m} - T_1 + 2\epsilon$$

$$m = m - T_1\sqrt{m} + \sqrt{m} - T_1^2 + 2\epsilon\sqrt{m} + \boxed{2\epsilon T_1} \longleftarrow \text{Ignore}$$

Therefore, $2\epsilon\sqrt{m} \cong T_1^2$ and $T_1 \cong \sqrt{2\epsilon}\sqrt[4]{m}$

By extension, for a second iteration, $T_2 \cong \sqrt{2T_1}\sqrt[4]{m}$ Total tolerance $T_t = T_1 + T_2$

For 8-digit accuracy, $\epsilon = .5 \times 10^{-8}$ and $T_1 = 10^{-4}\sqrt[4]{m}$

For 10-digit accuracy, $\epsilon = .5 \times 10^{-10}$ and $T_1 = 10^{-5}\sqrt[4]{m}$

Working within these tolerances, tables of linear segments may be constructed. The number of segments is minimized for a given accuracy, simultaneously with minimizing the number of digits in the multiplier and constant term for least execution time. Tables for some common accuracies are shown here.

$A_1 \cong aX + b$ where X = most significant part of m

8-digit			10-digit			12-digit		
Range	a	b	Range	a	b	Range	a	b
.01–.02	4.1	.060	.01–.02	4.2	.0585	.010–.014	4.58	.05439
.02–.03	3.2	.078	.02–.03	3.1	.0803	.014–.020	3.84	.06482
.03–.08	2.2	.110	.03–.05	2.5	.0991	.020–.028	3.23	.07712
.08–.18	1.4	.174	.05–.08	2.0	.1240	.028–.040	2.72	.09153
.18–.30	1.0	.247	.08–.13	1.6	.1545	.040–.056	2.29	.10876
.30–.60	0.8	.304	.13–.23	1.2	.2060	.056–.076	1.95	.12781
.60–1.0	0.6	.409	.23–.39	0.9	.2749	.076–.105	1.66	.15004
			.39–.60	0.7	.3550	.105–.145	1.42	.17548
			.60–.84	0.6	.4148	.145–.195	1.21	.20596
			.84–1.0	0.5	.5005	.195–.260	1.05	.23745
						.260–.350	0.91	.27395
						.350–.470	0.78	.31953
						.470–.630	0.68	.36649
						.630–.820	0.59	.42301
						.820–1.00	0.52	.48005

Note that range limits are also chosen for minimum number of digits, for minimum TLU time.

Slight adjustments to these tables are possible. Because of the unequal interval in arguments, address modification from the argument is usually impractical; the normal method is to truncate the argument to .xx or .xxx unrounded and do a table lookup on comparison. Because of rounding overflow the subroutine is easier to write if the $\sqrt{.99999999}$ with even power maintains the same mantissa for the square root. An early test for this condition will usually save program steps inasmuch as overflow is guaranteed never to occur. Other tables could be constructed for different accuracies, but if more than 12 digits are needed it will probably be better to use 3 iterations. A similar method is also possible for binary machines with VET.

Example: Find the $\sqrt{.12345678}$

$A_1 = 1.4\ (.123) + .174 = .346 \ldots\ldots\ldots$

$A_2 = .5\ (.346 + .35681) = .35141$

$.12345678 \div .346 = .35681$

$.12345678 \div .35141 = .351318346$

$\sqrt{} = .5\ (.35141 + .351318346) = .35136417$

or,

$$\frac{.12345678 - (.35141)^2}{.70282} = \frac{-.0000322081}{.70282}$$

$$-.00004583 + .35141 = \sqrt{} = .35136417$$

TABLES FOR AUTOMATIC COMPUTATION

HERBERT S. WILF
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White Plains, New York

I. Introduction:

Tables in use today generally give, for each of a set of values of a variable x, the corresponding value of the tabulated function f(x). It is historically clear why tables are made in this manner, but the demands of high speed digital computation led the present writer to inquire whether this is indeed the useful way to make a table for an automatic computer.

The normal use of a table of values in digital computation is to store the tabular values, at equally spaced arguments, to compute the value of x in some manner, extract the two table entries which surround x and interpolate linearly for f(x). Since the final product is this interpolated value one is led to ask whether the number $f(x_0 + nh)$ is the "best" number to insert in the n^{th} tabular position if we wish to optimize the accuracy, on the average, of the final interpolated function values. It is immediately clear that it is not, as may be seen most simply by considering a function which always lies above the chord connecting any two points on its graph.

Figures 1 and 2 below illustrate the function f*(x) which is actually used in the computation in the case of first, a function tabulated conventionally and second, tabulated by one of the methods to be described below.

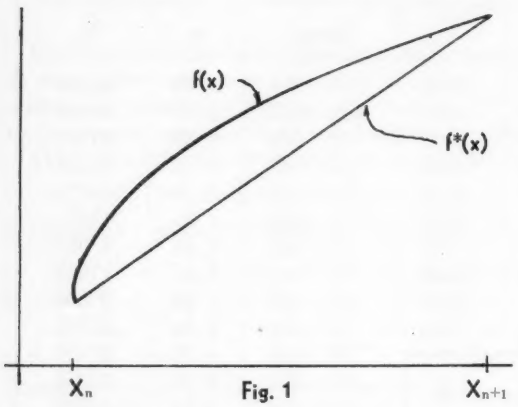


Fig. 1

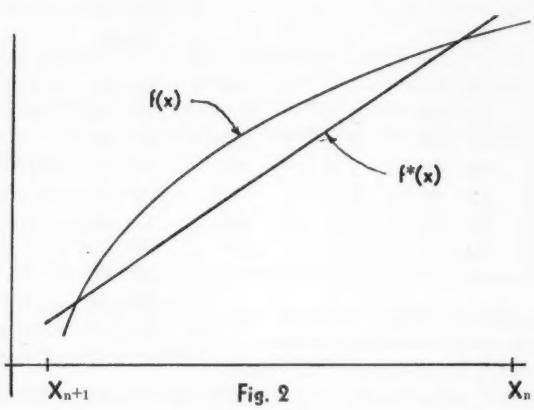


Fig. 2

It is clear that in many cases, one can do considerably better, accuracy-wise, if one drops the constraint, which may be unnecessary in digital computation, that the n^{th} tabular entry be exactly $f(x_0 + nh)$.

II. Statement of the Problem:

Formally, we are given a function f(x) and a set of points x_n, where $x_n = nh + x_0$ $(n = 0, 1, \cdots, N)$. Let $g_0, g_1, \cdots, g_N$ denote the set of entries to be determined.

Define $k_n(x)$ by

a) $k_n(x_n) = g_n$
b) $k_n(x_{n+1}) = g_{n+1}$
c) k_n is a straight line.

Finally, let f*(x) denote the function defined for $x_0 \leq x \leq x_N$ which takes the value $k_n(x)$ when x lies between x_n and x_{n+1}. Then f*(x) is the function which will ultimately be used in the computation.

Our problem now is to determine $g_0, g_1, \cdots, g_N$ in such a way that in some sense f*(x) lies as close as possible to f(x).

III. The Least Squares Relative (LSR) Modified Table:

The LSR results from minimizing

$$(1) \qquad \phi(g_0, g_1, \cdots g_N) = \int_{x_0}^{x_N} \left[\frac{f^*(x) - f(x)}{f(x)}\right]^2 dx,$$

where we will assume that $|f(x)| \geq c > 0$ on $[x_0, x_N]$. Writing

$$\phi(g_0, \cdots, g_N) = \sum_{n=0}^{N-1} \int_{x_n}^{x_{n+1}} \left[\frac{k_n(x)}{f(x)} - 1\right]^2 dx,$$

substituting

$$(2) \qquad k_h(x) = g_h + \frac{g_{h+1} - g_h}{h}(x - x_h),$$

and taking partial derivatives of ϕ with respect to each of the g_h, we get $N + 1$ simultaneous linear algebraic equations:

$$(3) \qquad [\alpha_{p-1} - \epsilon_{p-1}]g_{p-1} + [\beta_p + \epsilon_p - 2\alpha_p + \epsilon_{p-1}]g_p + [\alpha_p - \epsilon_p]g_{p+1} = \gamma_p - \delta_p + \delta_{p-1} \qquad (p = 0, 1, \ldots, N)$$

to solve for the g_p, where we have written

$$(4) \qquad \alpha_p = \frac{1}{h}\int_{x_p}^{x_{p+1}} \frac{x - x_p}{f^2(x)}\,dx \qquad (p = 0, \ldots, N-1)$$

$$(5) \qquad \beta_p = \int_{x_p}^{x_{p+1}} \frac{dx}{f^2(x)} \qquad (p = 0, \ldots, N-1)$$

$$(6) \qquad \gamma_p = \int_{x_p}^{x_{p+1}} \frac{dx}{f(x)} \qquad (p = 0, \ldots, N-1)$$

$$(7) \qquad \delta_p = \frac{1}{h}\int_{x_p}^{x_{p+1}} \frac{x - x_p}{f(x)}\,dx \qquad (p = 0, \ldots, N-1)$$

$$(8) \qquad \epsilon_p = \frac{1}{h^2}\int_{x_p}^{x_{p+1}} \frac{(x - x_p)^2}{f^2(x)}\,dx \qquad (p = 0, \ldots, N-1)$$

$$(9) \qquad \alpha_{-1} = \epsilon_{-1} = \delta_{-1} = \beta_N = \epsilon_N = \alpha_N = \gamma_N = \delta_N = 0.$$

Because of the form of Eq. 3 the solution may be obtained readily by writing

$$(10) \qquad \begin{cases} g_p = \lambda_p g_{p+1} + \mu_p \\ g_{N+1} = 0 \end{cases}$$

from which the recurrence relations

$$(11)\quad \begin{cases} (a)\ \lambda_{-1} = 0 \\ (b)\ \lambda_p = -\,u_p\{u_{p-1}\,\lambda_{p-1} + V_p\}^{-1} \end{cases}$$

$$(12)\quad \begin{cases} (a)\ \mu_{-1} = 0 \\ (b)\ \mu_p = (C_p - u_{p-1}\,\mu_{p-1})\,(u_{p-1}\,\lambda_{p-1} + V_p)^{-1} \end{cases}$$

follow. Here we have written

$$(13)\quad u_n = \alpha_n - \epsilon_n$$

$$(14)\quad V_n = \beta_n + \epsilon_n - 2\alpha_n + \epsilon_{n-1}$$

$$(15)\quad C_n = \gamma_n - \delta_n + \delta_{n-1}$$

IV. The Least Squares Absolute (LSA) Modified Table:

Here we minimize

$$(16)\quad \phi(g_0, g_1, g_2, \ldots, g_N) = \int_{x_0}^{x_N} [f^*(x) - f(x)]^2\,dx$$

which leads to the equations

$$(17)\quad 2g_p + \tfrac{1}{2}g_{p+1} + \tfrac{1}{2}g_{p-1} = \alpha_p - \beta_p + \beta_{p-1}$$

$$(18)\quad \beta_{-1} = g_{-1} = g_{N+1} = 0 = \alpha_N = \beta_N$$

$$(19)\quad \alpha_p = \frac{3}{h}\int_{x_p}^{x_{p+1}} f(x)dx$$

$$(20)\quad \beta_p = \frac{3}{h}\int_{x_p}^{x_{p+1}} f(x)\left(\frac{x - x_p}{h}\right)dx.$$

These can be readily solved by the device previously used.

V. Conclusions:

The criterion of least squares integrated error minimization is not the natural one in numerical approximations. Much preferable would be MMR and MMA for minimax relative and absolute error modified tables. An elegant and useful algorithm for the construction of such tables has so far eluded the author.

Finally, since these tables are almost always the appropriate kind to use in automatic computation, it is to be hoped that they will be prepared for all the standard mathematical functions and with a variety of mesh widths for each.

VI. An Example:

We give below a complete LSR modified table for $f(x) = \sqrt{x}$, $x_n = n + 1$ $(n = 0, \ldots, 9)$.

The tabular values are denoted by $\phi(x)$, and the actual values of $f(x)$ are tabulated for comparison. It will be noted that $\phi(x_n) > f(x_n)$, and that the line $k_n(x)$ cuts $f(x)$ in two points inside of every interval. The maximum relative error from using $\phi(x)$ with linear interpolation is about 1.28%, compared with 1.49% with $f(x)$ and linear interpolation.

Table I

x	ø(x)	f(x)	x	ø(x)	f(x)
1	1.012704	1.000000	6	2.450921	2.449490
2	1.423418	1.414214	7	2.646876	2.645751
3	1.735359	1.732051	8	2.829339	2.828427
4	2.002788	2.000000	9	3.000835	3.000000
5	2.237870	2.236068	10	3.162847	3.162278

A PROGRAMMED BINARY COUNTER FOR THE IBM TYPE 650 CALCULATER

B. C. KENNY and J. A. HUNTER
Westinghouse Electric Corporation, Baltimore, Maryland

In a recent computational job on the IBM 650 (with 653) the authors found it necessary to perform a calculation which depended upon a sequence of n yes-no decisions. It was required to repeat the procedure for all 2^n possible sequences. Since n was less than eleven, it was convenient to express each yes-no sequence by an integer composed of eights and nines. The "Branch on Distributor 8" instruction was then used by the program to interpret the current sequence and thereby control the calculation.

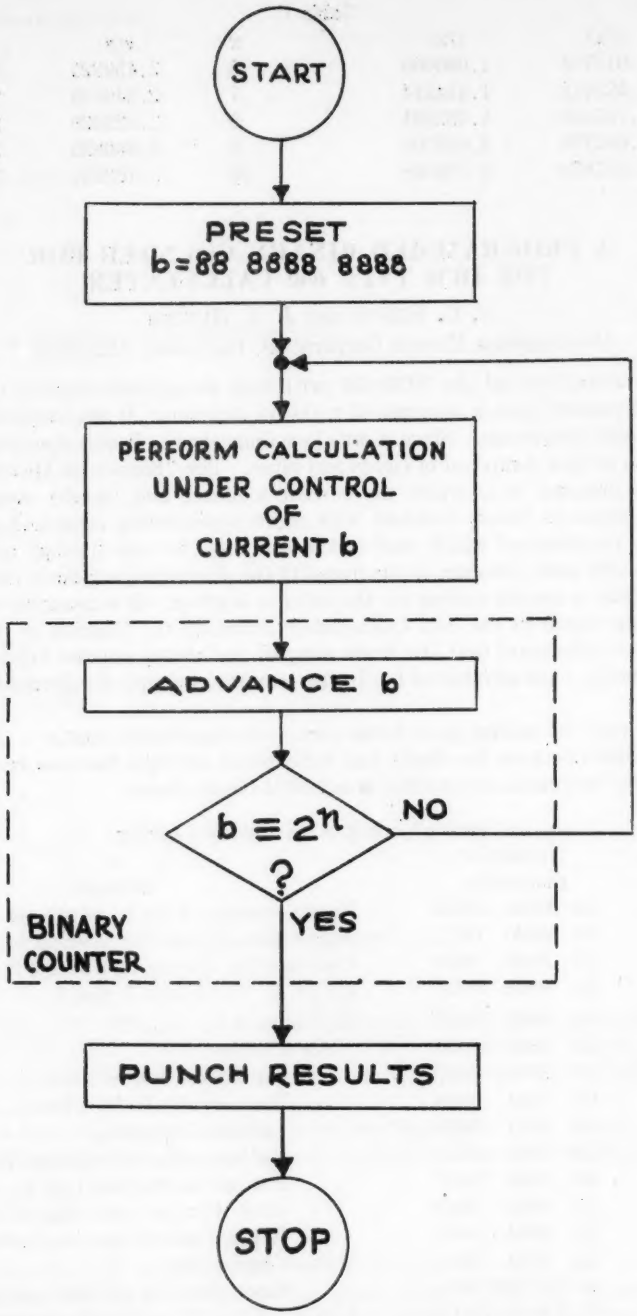
Regarding the sequences as binary numbers with eights representing zeros and nines denoting ones, a binary counter was programmed which enabled the computer to step through all sequences in turn. The pertinent logic of the main program is illustrated in the accompanying block diagram.

Following the diagram a specific coding for the counter is given. It is assumed that this program is stored on the magnetic drum in the cells immediately following the location of the current "binary" number, b. It is also understood that the drum copy of the binary counter routine is read into high speed storage afresh before each advance of b. In this way the contents of cells 9001 and 9004 are preset automatically.

It should be noted that the coding given below carries the implication that $n < 10$. For $n = 10$, the program must be modified because the simple test indicated at cell 9015 becomes impossible and because the scheme for altering the branch instruction in cell 9004 breaks down.

A Specific Coding of the Binary Counter

Core Location	*Number or Instruction*	*Remarks*
9000	bb bbbb bbbb	Binary number, b, to be advanced. 8's and 9's.
9001	00 0000 0001	Adjustable constant for altering b.
9002	01 0000 0000	Constant for altering instruction in 9004.
9003	65 9000 9004	*ENTER* Put b into D and L.
9004	91 9013 9005	Test digit of b. 8 or 9?
9005	16 9001 9006	If 9: Change to 8.
9006	20 9000 9007	Put altered b into 9000.
9007	65 9001 9008	Put constant in 9001 into L.
9008	35 0001 9009	Left shift one place.
9009	20 9001 9010	Replace adjusted constant in 9001.
9010	65 9004 9011	Put test instruction into L.
9011	15 9002 9012	Alter it to test next digit of b.
9012	20 9004 9003	Replace altered test instruction in 9004.
9013	15 9001 9014	If 8: Change to 9.
9014	20 DRUM 9015	Store altered b on drum and in D.
9015	9X PROG PNCH	*EXIT* If $b < 2^n$, return to program. If $b = 2^n$, go to output routine. $X \equiv n + 1 \pmod{10}$.



LOGIC OF MAIN PROGRAM

UNUSUAL APPLICATIONS DEPARTMENT

Statement of Policy

Too much of the material published on new, unusual or novel applications does not properly belong in a periodical concerned with *computers*; operations research studies in the prediction of elections, or the writing of music do not *usually* call for any thought about the computer or program. On the other hand, in this day and age, writing programs in machine language (that dying art) is becoming an unusual application. Among the criteria for defining an unusual application are the following:

1. The computer is not an afterthought to the analysis of the problem;
2. The computer is an integral part of the solution to the problem.

Some of the problems of interest here, are those involving the integration of the computer into systems which place demands upon the "intelligence" and "abilities of reception" of the *Computer plus program* as well as studies of *computer plus program* learning processes, and *computer plus program* recognition processes.

Where possible, remarks are desired on the influence of these problems on machine design and programming methodology.

STANDARDS DEPARTMENT

Intent and Policy

The function of the Standards Department shall be to maintain criteria, not as a measure of quality or of esthetics, but as intelligible means for effective communication within the computer field. It shall be the aim of the Standards Department to advance the science of computation by reducing semantic barriers and by supplying a common ground of comprehension for both technical and lay personnel.

To accomplish this end work shall be continued toward an official glossary of terminology by the publication of extensions, modifications, and suggestions concerning this glossary. Furthermore, the Standards Department shall attempt to set forth and to resolve, when possible, differences in terminology which exist in terms common to engineering, design, systems, programming, automatic coding and programming, and all such categories pertinent to the field.

OFFICIAL NOTICES DEPARTMENT

Statement of Policy

This department will carry official notices of the Association for Computing Machinery.

It will include announcements and preliminary programs of national meetings of the ACM and of national and international activities in which the ACM participates. Announcements relative to Joint Computer Conferences will be included.

The officers and the Council of the ACM will use this department to inform the members of appointments, resolutions, and other activities.

Results of elections of officers of the ACM will be published here.

All items for publication in this section should be submitted directly to the Managing Editor.

Official Notices

With this issue the Association begins the publication of a new journal. The Editorial Board for the "Communications" is listed on the inside front cover.

The Western Joint Computer Conference will be held May 6, 7, and 8 at the Ambassador Hotel in Los Angeles, California. The theme of the conference is "Contrasts in Computers." In the future, announcements of Joint Computer Conferences will be made in this journal well in advance of the closing date for acceptance of papers.

The Digital Computer Newsletter of the Office of Naval Research will be published regularly in the "Communications." It will normally appear in the issues for January, April, July, and October. Because of problems inherent in the birth of a new journal the first ONR Newsletter to appear in these "Communications" will be published in the February issue.

ACM FINANCIAL STATEMENT
First Nine Months—1957

Bank Balance—January 1, 1957		$24,559.73
RECEIPTS		
Dues (present year, 1957)—2762 members	$16,572.00	
Dues (present year, 1957)—1 member (residue)	3.00	
Dues (future years)	0.00	
Dues (past years)—4 members	24.00	
Conference Proceedings	288.00	
Toronto Proceedings	63.00	
ACM Journal	7,753.75	
Balance from Los Angeles Summer Meeting	2,561.68	
Premium on Canadian Money Received	1.79	
Information Processing Systems	3.00	
Glossary Sheet	0.50	
Redeposit of Checks	24.10	
Surplus NJCC (all 1956 Conferences)	4,904.37	
Interest on Savings Account	75.00	
Sale of Publication	1.25	
Total Receipts		$32,275.44
TOTAL		$56,835.17

DISBURSEMENTS

New York Academy of Sciences		
Administrative Services	$ 3,660.00	
Cash Account	750.00	
Directory	41.89	
Stationery	340.15	
Telephone and Telegraph	146.46	
Waverly Press (Journal)	9,344.76	
Journal—Editorial Service	250.00	
Inter City Paper Company	296.53	
Proof Reading Roster	221.50	
Returned checks	58.50	
Compton Press (Directory)	950.00	
Advance for 1957 Houston Meeting	2,000.00	
Symposium on New Computers—Advance	1,300.00	
Reprints of ACM article	34.32	
Legal Services	50.00	
Stationery	58.08	
EJCC 1957 Advance	300.00	
WJCC 1958 Advance	300.00	
JCC Secretary-Treasurer's Fund	150.00	
Expenses—Travel to Houston	199.57	
Total Disbursements		$20,451.76
Bank Balance*—October 1, 1957		36,383.41
TOTAL		$56,835.17

*Note: $20,075 is deposited in a Savings Account in the Chase Manhattan Bank, leaving $16,308.41 in our Checking Account on October 1, 1957.

CHARLES CONCORDIA, *Treasurer*
Association for Computing Machinery, Inc.

NEWS AND NOTICES

Statement of Policy

The News and Notices Section of the Communications will be a collection of short items of information and news about computers and the organizations and people which use them and design them. The Section will be comprised of six parts as follows:

1. National ACM Activities. An unofficial report of items of interest from the National Council meetings will be recorded.
2. ACM Chapter News. This will include items of chapter business such as elections, projects, and programs.
3. Coming Events. A calendar of events in the computer field and in related fields will be maintained.
4. University Activities. Curricula and news items will be published, as well as activities of cooperative university groups.
5. News Items. This part will include brief items on the following areas: personnel changes, promotions, organizational changes, new computer installations, new equipment, and new computer programs.
6. Cooperative Programming Groups. Short news items on the activities of SHARE, USE, DUO, and GUIDE.

As can be seen from the above descriptions, the only qualifications for the inclusion of an item in the News and Notices Section is that it be reasonably brief and that it be of interest to some segment of the computer field. We hope to make this Section the most comprehensive collection of news items in the computer field available anywhere. As time goes on, new parts to the Section may be added.

It is the aim of our staff to distinguish between rumor and established fact so that all items for this Section will be reliable information. We will be glad, however, to publish corrections for any inadvertent mistakes on our part.

To obtain the information, a large number of "reporters" will be chosen in all sections of the country from computer manufacturers, industry, and universities. Before each appearance of the Communications, items will be solicited from this group. Anyone interested in acting as a reporter should contact Dr. Walter F. Bauer, Director, Computation and Data Reduction Center, The Ramo-Wooldridge Corporation, P. O. Box 45564 Airport Station, Los Angeles 45, California. News items on University Activities should be sent to Dr. Bernard A. Galler, Department of Mathematics, University of Michigan, Ann Arbor, Michigan.

(Editor's note: the readers will notice a preponderance of material from the west coast for this issue since our national collection scheme has not yet been fully established.)

National ACM Activities

At the December 1957 ACM Council Meeting in Washington, D. C., petitions for new chapters at St. Louis and Milwaukee were approved. Tentative approval of the petition of the Southwest Chapter (for Arizona, New Mexico, and West Texas) was granted on the condition that they consider another name. The National ACM has defined the term "Southwest" to explicitly include a particular area of the country which does not coincide with the definition of Southwest in the title of this chapter.

The question of financial aid to local chapters was again raised. (The Los Angeles Chapter recommended at the last National Council meeting that refunds of a portion of the National dues be made to the chapters.) In a letter to the Council, the Eglin Air Force Base Chapter expressed opposition to any type of per capita refund to chapters; they would rather receive aid in the form of visiting lecturers and other program assistance. A third position is that financial support be given the chapters to help them get started, followed by lectureship support only. No decision was made; Raymond Davis, representative for Southwest Section, will write the various chapter chairmen asking their opinions on the type of support they would prefer.

The total membership of the ACM was 3181 on December 1, 1957. A new roster will be published, possibly with both alphabetical and geographical listings.

The committee which studied institutional memberships submitted a report recommending that such memberships be established, requiring annual dues of $250.00. The institutional member would receive two copies of the Journal and a free membership for one person to be nominated by the institutional member. The committee's proposal was accepted; it will draw up a set of qualifications for institutional membership and formulate the necessary constitutional amendments.

A group in the Los Angeles area submitted a petition signed by thirty-one people proposing that two nominations be made for the offices of President and Vice President of the National ACM. At the present time, the nominating committee may do as it sees fit. The present nominating committee has already indicated that it favors at least two nominees for each of the offices to be elected by the membership in 1958. (This committee must submit its report to the Council by March 1, 1958. The election will then take place so that officers may begin their terms the beginning of May, 1958.) The National Council did not take direct action on the petition, but approved support of whatever action the nominating committee proposes in answer to this petition, such proposal to be submitted to the Executive Committee for decision.

The German Mathematical Society, GAMM, has been studying the problem of a common algebraic language for technical and scientific computing machines. Several members of the Society from Germany and Switzerland visited the United States this summer in reference to this subject. They now propose a Conference on an international basis to be held in Switzerland in early 1958. The purpose of such a Conference would be threefold:

1. It would be an international meeting of interested scientists.
2. It might achieve an agreed set of specifications of what common languages should be.
3. It might agree on one common language.

That such agreements might be possible is indicated in the work to date by the Germans, in which they have been willing to use English words in their language specifications. The National ACM Council approved a motion to support the sending of three university representatives to this meeting with the amount of financial support to be decided essentially by the Treasurer as he feels appropriate. Three members from industry will join the university representatives to form a six-man United States delegation. Those interested in expressing an opinion should write to Dr. J. W. Carr, University of Michigan.

An invitation will be extended to the USSR to attend the 1958 ACM meeting in Urbana, Illinois. Participation by the USSR would have to be on a reciprocal basis as required by the U. S. State Department. Dr. Willis Ware, RAND Corporation, as Chairman of the 1958 Western Joint Computer Conference, has already advised the U. S. State Department of our interest in having a Russian delegation attend the Los Angeles conference in May.

ACM Chapter News

Los Angeles Chapter:

At the November 6, 1957, meeting of the Los Angeles Chapter, R. W. Bemer, IBM, and R. Douthitt, Remington Rand, spoke on "Automatic Programming" to an audience of 180 people. The program for December was "Achieving Compatibility in Data Processing Systems" by E. Tomash of Telemeter Magnetics. January's meeting will emphasize differential analyzers, both analog and digital. The title is "Simulation Is Our Business" and the speakers are W. Kindle, Electronic Associates, and G. Post, Litton Industries.

The Chapter will sponsor a full day's technical program the day following the Western Joint Computer Conference. Eight papers will be presented on new equipment in the field of small computers and input-output equipment. The meeting will be publicized through the WJCC.

At a recent meeting of the Council it was decided to sponsor a full day's technical meeting on computing in late summer or early fall, 1958. J. D. Madden, Systems Development Corporation, was appointed general chairman for the meeting. The meeting is to emphasize the contribution of the younger professional people in the computer field and attendance and technical paper contributions will be solicited especially from that group. It is believed that this represents the first local or sectional technical meeting of the growing ACM.

The Los Angeles Chapter is proud to announce that it has approximately 460 people on its membership rolls and is aiming for 500.

San Diego Chapter:

Recent technical meetings of the San Diego Chapter have presented the following programs: October, 1957—Randy Porter of Boeing Airplane Company spoke on "Numerical Control of Machine Tools"; November, 1957—Dr. Walter F. Bauer of The Ramo-Wooldridge Corporation spoke on "Ultradatic—A Conjectural Computer"; December, 1957—Representatives of three leading manufacturers of large computers, Hal Judd from IBM, Herman Englander from Remington Rand, and Greg Welton from Burroughs ElectroData, spoke on "Digital Computer Developments."

The Chapter is now working on preparations for the ACM program during San Diego Engineering Week in February, 1958.

Coming Events

Second Conference on Automation
Sponsored by EIA
January 22–24, 1958; Arizona State College, Tempe, Arizona

American Mathematical Society—64th Annual Meeting
January 28–30, 1958; Cincinnati, Ohio

GUIDE Meeting
January 29–31, 1958; Biltmore Hotel, New York City, New York
Contact: E. G. Law, North American Aviation, Los Angeles 45, California

The Mathematical Association of America—41st Annual Meeting
January 30–31, 1958; University of Cincinnati and Hotel Sheraton-Gibson, Cincinnati, Ohio

Research Session on Information Processing at the AIEE Winter Meeting
February 6, 1958; Hotel Statler, New York City, New York

Industrial Relations Conference
Sponsored by EIA
February 20–24, 1958; Town and Country Hotel, San Diego, California

American Mathematical Society Meeting
February 22, 1958; New York City, New York

SHARE Meeting
February 26–28, 1958; Washington, D. C.
Contact: Frank Wagner, North American Aviation, Los Angeles 45, California

American Management Association Electronics Conference, and EDP Equipment Exhibit
March 3–5, 1958; Statler Hotel, New York City, New York

IRE National Convention
March 24–27, 1958; New York Coliseum and Waldorf-Astoria Hotel, New York City, New York

USE Meeting
March 26–28, 1958; Washington, D. C.

American Mathematical Society Meetings
April 18–19, 1958; Chicago, Illinois
April 18–19, 1958; Stanford, California

Conference on Functional Approximations
April 21–23, 1958; University of Wisconsin, Madison, Wisconsin
Contact: Dr. A. S. Householder, Oak Ridge National Laboratories

Electronic Components Conference
April 22–24, 1958; Ambassador Hotel, Los Angeles, California

American Mathematical Society
April 25–26, 1958; New York City, New York

National Symposium on Microwave Theory and Techniques
May 5–7, 1958; Stanford University, Stanford, California
Western Joint Computer Conference—"Contrasts in Computers"
May 6–8, 1958; Ambassador Hotel, Los Angeles, California
Contact: Dr. Willis Ware, The RAND Corporation, Santa Monica, California
Los Angeles Chapter ACM Symposium "Small Automatic Computers and Input-Output Equipment—A Report from the Manufacturers"
May 9, 1958 (the day following WJCC); Ambassador Hotel, Los Angeles, California
Contact: P. Armer, The RAND Corporation, Santa Monica, California
International Automation Exposition and Congress
June 9–13, 1958; Coliseum, New York City, New York
1958 ACM National Conference
Summer, 1958; University of Illinois, Urbana, Illinois
American Mathematical Society Meeting
June 20, 1958; Corvallis, Oregon
American Mathematical Society—63rd Summer Meeting
August 25–30, 1958; Cambridge, Massachusetts
The Mathematical Association of America—39th Summer Meeting
August 25–28, 1958; Cambridge, Massachusetts
SHARE Meeting
September 10–12, 1958; San Francisco, California
American Mathematical Society Meeting
November, 1958; Evanston, Illinois
Eastern Joint Computer Conference
December, 1958; Boston, Massachusetts
American Mathematical Society—65th Annual Meeting
January 20–22, 1959; Philadelphia, Pennsylvania
1959 ACM National Conference
Summer, 1959; Massachusetts Institute of Technology, Cambridge, Massachusetts
Contact: F. Verzuh, MIT

University Activities

A group of university computer installations in the Midwest have been meeting periodically to discuss common problems. The first meeting at Ann Arbor, Michigan, in 1956, led to standardization of the IBM 533 control panel used with the IBM 650 computer and adoption of the Carnegie Institute of Technology IT Compiler and the IBM S. O. A. P. II system as the standard languages. Since that time meetings have been held at Columbus, Ohio, and in Houston, Texas, in conjunction with the ACM meeting in June, 1957.

The latest meeting was held in Pittsburgh under the joint sponsorship of Carnegie Institute of Technology and the University of Pittsburgh on December 6, 7. The program included: a panel discussion by John W. Carr III, Saul Gorn, and Alan J. Perlis on Numerical Analysis Curricula; a report by John W. Carr III on Computers in Europe; a description by Wayne Martin of Data-Processing Courses at Indiana University; and a talk by Tibor Fabian on an Economic Decision-Making Game used at the University of California at Los Angeles. The next meeting will be held in May or June, 1958; time and place to be announced.

An important contribution to educational training and research in the computing field was recently made by National Cash Register Company, Electronics Division, Hawthorne, California, with their gift of an NCR-102D General Purpose Digital Computer to the University of Southern California. It is already in use for training students in the design and application of computers and for new research in measuring man's intelligence. Correlation studies of tests for creativeness made by USC psychologists

for the Office of Naval Research indicate that the old standard IQ test with its single score may soon be replaced by analysis of some 45 established factors of man's intellect.

The Western Data Processing Center at the University of California at Los Angeles recently received from Professor Edward Laurie of the Division of Business, San Jose State College, a preliminary copy of an extensive bibliography of business data processing, currently in preparation. Professor Laurie's project covers periodical references, proceedings, and some manufacturers' publications, as well as printed books. Extensively cross-referenced, the preliminary bibliography contains 775 entries. In its final form Professor Laurie estimates it will contain about 1500 entries. We regret to say that neither WDPC nor Professor Laurie has copies available for distribution at the present time.

Kendall R. Wright has joined the Western Data Processing Center at UCLA as Associate Research Analyst and Chief of Operations on a full-time appointment. Mr. Wright was formerly a data processing specialist and systems analyst at the Hanford Atomic Products Operation of the General Electric Company.

Also at WDPC, Associate Professor R. Clay Sprowls has taken one-third time leave from his appointment in the School of Business Administration to act as Associate Research Statistician for WDPC and assist the development of their educational program.

Plans for the colloquium series for Claremont Colleges, Claremont, California, designed as an indoctrination course and feasibility study for the installation of a digital computing center on the Claremont campus, have been expanded to a spring semester course for interested faculty members. Mr. Douglas Bolitho of ElectroData Corporation is in charge. Dr. Chester Jaeger of Pomona College is the faculty coordinator.

Tests are now underway demonstrating and improving the effectiveness of using closed circuit television for classroom demonstrations of computer operation. The Western Data Processing Center at UCLA, in connection with the school's Department of Theatre Arts, piped a program of IBM 650 console operations from their machine installation to some 25 people in a classroom on the floor below. This was a large improvement since previous actual demonstrations at the machine console were only effective with groups of less than five people.

News Items

Three new IBM 704's are now being installed in the Southern California area—at Marquardt Aircraft, Northrop Aircraft, and for the Space Technology Laboratories, a division of The Ramo-Wooldridge Corporation.

Dr. Gilbert King has left International Telemeter Corporation in West Los Angeles and will join IBM in Poughkeepsie, New York.

Broadview Research Corporation has announced the opening of a fourth office location, their new Data Processing Center in San Francisco. Dr. James A. Baker, formerly in charge of the digital computer group at University of California Radiation Laboratory in Berkeley, California, will head the Center's activities in furnishing computing service either on their own ALWAC-IIIE or other machines.

IBM and the University of California have announced a revision to their plans for installation of a 705 at the Western Data Processing Center. It will now be an IBM 709, to be delivered June 1, 1958.

Dr. H. Grosch will replace Dr. G. King as Western ACM Representative to the Joint Computer Conference.

Datamatic Division of Minneapolis-Honeywell has opened a Los Angeles branch for manufacturing of large-scale electronic data processing systems.

A transistorized airborne digital computer from Ramo-Wooldridge can handle all bombing, fire control, and navigation computation at required speed. The entire stored program computer, including drum and power supply, occupies only 4.19 cubic feet.

Computer Applications Laboratory, division of General Electric's computer activity in Phoenix, Arizona, has been formed to render computation service. Staff: 70 specialists and one IBM 704.

At the AIEE winter meeting, February 6, 1958, in New York City, a special research session will explore the concept of information itself as well as information processing and its relationship to the

electrical engineering in computer design. Representing the three fields involved, university laboratory study, industrial research, and computer manufacture, the following speakers will address the session: Dr. J. B. Wiesner of MIT, Dr. Simon Ramo of The Ramo-Wooldridge Corporation, and Dr. C. R. DeCarlo of IBM.

Daystrom Systems will soon complete a 30,000 square foot research facility near San Diego, California.

The RAND Corporation of Santa Monica, California, recently announced the formation of the Systems Development Corporation, established to carry on the activities previously performed by their Systems Development Division. A 20-million dollar contract for professional technical services to the Air Defense Command for SAGE system operations has been officially transferred to the new corporation.

A representative of the ACM Education Committee attended the December 12, 1957, general meeting of the Future Engineers of America. This growing organization, representing a group of branch chapters and associated science clubs in secondary schools throughout Southern California, offers technical counsel and programs to promising young students interested in scientific or engineering careers. Hal Hamilton of Librascope is president. This group might serve as an example or model for similar organizations to be created in geographical sections throughout the country. For information, contact Ross Pickett, Secretary, Future Engineers of America, 1111 South Fremont Avenue, Alhambra, California.

Bendix Aviation presented a G-15 Digital Electronic Computer playing the Bach Chorale and other Christmas music at the Ambassador Hotel in Los Angeles on December 18th. It was billed as a "dramatic application of the science of mathematics to the art of harmonics."

The people in the Los Angeles Data Processing Center of the Service Bureau Corporation are looking forward to moving into their new building at 2706 Wilshire Boulevard in January. The building is equipped for the 709 which is on order for delivery at the end of 1958.

Bruse Moncreiff, formerly in computer programming at AiResearch Manufacturing Company, has now joined IBM at Poughkeepsie, New York.

Cooperative Programming Groups

USE:

The November USE meeting in Dallas featured an unusual project. Several installations programmed the same two or three problems involving the solution of ordinary differential equations. The results were then presented to a meeting of the Mathematics Committee for comparison of routines, accuracy, and time.

The Data Reduction Division of White Sands Proving Ground is the newest member of USE.

GUIDE:

The election of new officers will be a principal item of business at the forthcoming GUIDE meeting in New York City, January 29–30–31, Hotel Biltmore. Also on the agenda are: automatic programming techniques; new equipment with particular emphasis on the 705 Model III; and experiences of members in the areas of operations and programming.

SHARE:

At the October, 1957 meeting in San Diego the following officers were elected:
Chairman—Frank Wagner, North American Aviation
Vice Chairman—Ben Ferber, Convair, San Diego
Secretary—Herb Bright, Westinghouse Bettis Plant
Board Members—Paul Armer, RAND; Lee Amaya, Lockheed; Walter Ramshaw, United Aircraft; and the outgoing chairman, Frank Engel, Westinghouse Electric.

The next meeting will be held February 26, 27, 28, 1958, in Washington, D. C.